Shea, H.S.  To what Extent can success in ninth grade algebra be predicted by use of certain Eighth grade criteria.

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Boston University

School Of Education

Thesis

To What Extent Can Success In Ninth
Grade Algebra Be Predicted By Use Of
Certain Eighth Grade Criteria

Submitted by

Harold S. Shea

(B. S. E., Fitchburg Teachers College, 1934)

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ments for the degree of Master of
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Approval Page


Thesis approved:



    First Reader William C. Kvaraceus
         Associate Professor of Education

    Second Reader Worcester Warren
         Professor of Education

    Third Reader Franklin C. Roberts
         Professor of Education

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# Chapter One

## INTRODUCTION

For the past two decades it has been necessary for public high schools to accept a large number of pupils who do not fit into some of the traditional courses which are offered in the curriculum. This is, in the main, due to the growth in registration in our secondary schools. This condition accounts for a large number of failures each year.
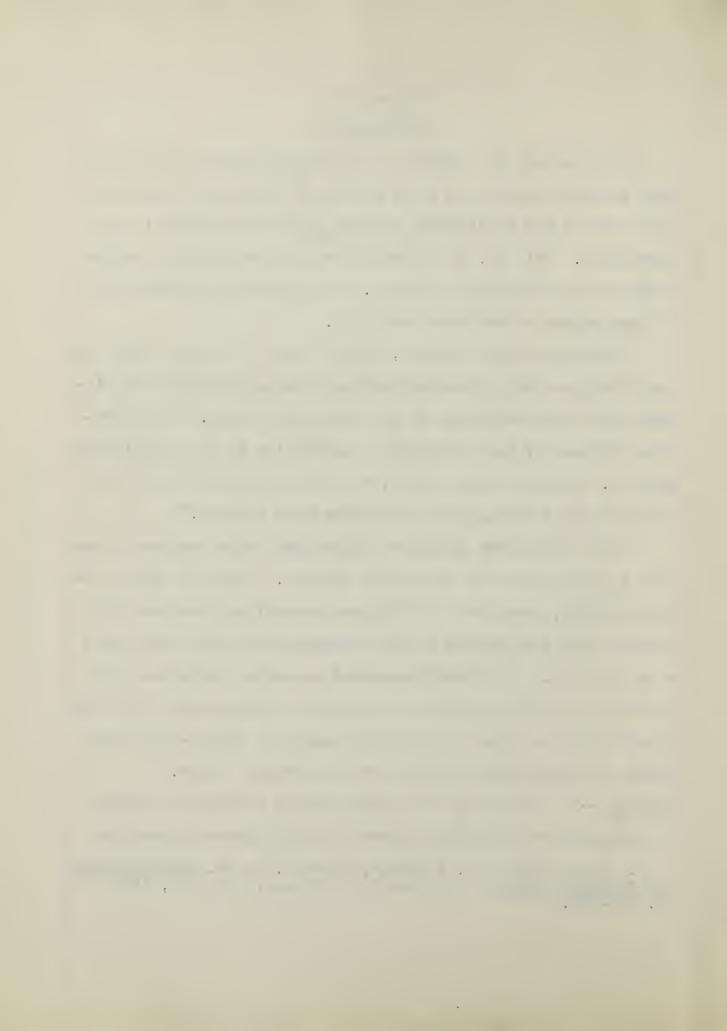
Concerning pupil failure, Hughes[1] says, "The money cost of pupil failure due to the instruction of repeaters has been figured many times and shown to be appallingly large. It is serious evidence of the inefficient functioning of the educational machine. There are some, also, who have pointed out the loss in human value through the circumstance of failure."

One of the worst pitfalls confronting large numbers of pupils is ninth grade or first year algebra. Annually school administrators, teachers, and guidance counselors have been confronted with the problem of what students can best pursue this vital subject. If a fairly accurate measuring technique were possible to predict success or failure in algebra much time and energy would be saved for a goodly number of pupils--time and energy to pursue other courses of real value to them.

Problem---The purpose of this study was to attempt to discover a technique for predicting success in ninth grade algebra for

1. Koos, Leonard V. & Hughes, James M. et al, _Administering The Secondary School_, American Book Company, New York, 1940 pp. 180-181.

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students of the Athol, Massachusetts and Orange, Massachusetts
High Schools on the basis of certain eighth grade criteria.

Scope---The obtained scores on the Columbia Research Algebra
Test, Part I, Form A of sixty students in the Athol and Orange,
Massachusetts High School who had completed one half year of
ninth grade algebra in February of 1948 were analyzed in res-
pect to the following criteria.

1. Eighth grade obtained I. Q. score on the Pintner Gen-
   eral Ability Test, Verbal Series, Intermediate Test,
   Form A.

2. Eighth grade obtained score on the Orleans Algebra
   Prognostic Test, Form A.

3. Eighth grade obtained score on the Stanford Achieve-
   ment Advanced Arithmetic Test, Form D.

4. Eighth grade obtained score on the Kuder Preference
   Record, sub-test computational.

5. Eighth grade teachers' mark in arithmetic.

A further amplification of the statistical procedures em-
ployed in the analysis of the scores and as a basis for predic-
tion of success will be found in Chapters III and IV.

<div align="center">Limitations Of This Study</div>

The teacher factor---The teacher factor, and it is recognized
as important, was not considered in the study. The sixty stu-
dents used as samplings entered their two respective high
schools and the ninth grade course in algebra with preparation
given by two different eighth grade teachers. The same situ-
ation existed in regard to the first semester of algebra-namely

two different teachers.  Because of the geographical location
of the two high schools employed in the study, there was no at-
tempt to control this factor.

The small sampling---A further limitation is that this study
was limited to two high schools, Athol, Massachusetts, and
Orange, Massachusetts.  If the testing program carried on in
connection with the study had been enlarged to include several
high schools, the validity of the study would be on firmer
ground.

A REVIEW OF THE MOST PERTINENT LITERATURE

The problem of prediction of success in various school subjects, and algebra in particular, has been the area of considerable research by educators in the last two decades.

McCuen[2] in a study of 116 students who had completed the first semester of algebra attempted to predict a student's success on the relative value of the following tests: (1) the Terman Group Intelligence Quotient, (2) the score on the arithmetic computation section of the Revision of the Stanford Achievement Test, (3) the score on the number series section of the Terman Group Intelligence Test, and (4) the score on the arithmetic section of the Terman Group Intelligence Test. He concluded that the Terman Group Intelligence Quotient as determined by the Terman Group Test of Mental Ability with a correlation of .42 was the best predictive criterion of a combination of achievement, prognostic, and intelligence tests.

Dunn[3] in analyzing the scores of 213 pupils of the Shumway Junior High School of Vancouver, Washington, in respect to the four following criteria (1) Orleans Algebra Prognostic Test, (2) Stanford Achievement Test (Total score) (3) Stanford Arithmetic Achievement Test, and (4) Terman Group Test of Mental Ability concluded that the teacher factor is very influential

2. McCuen, Theron L., "Predicting Success In Algebra, Journal of Educational Research, January, 1930, pp. 72-74.

3. Dunn, W. H., "Predicting Success In Ninth Grade Algebra," Unpublished Thesis, University of Washington, 1931.

in determining the size of the correlation between achievement in algebra and the various predictive criteria taken separately and in combination.

Grover[4] in an experiment with 200 pupils in two Oakland, California Junior High Schools, using the Terman Group Intelligence Test, the Orleans Algebra Prognostic Test, and a standard achievement test in arithmetic as the predictive criteria, and the Columbia Research Bureau Algebra Test as the achievement criterion, arrived at the following correlations: (1) Columbia Research Algebra Test and the Terman Group Test of Mental Ability .48 (2) Columbia Research Algebra Test and the Orleans Algebra Prognostic Test .50 (3) Columbia Research Algebra and standard achievement test in arithmetic .61.

The results of his study also showed that the composite criteria of Intelligence Quotient and Prognostic score with a correlation of .65 were better than any single criterion.

In 1933 Dickter[5] made a study of 83 pupils in Upper Darby, Pennsylvania making use of the Otis Group I. Q. score, teachers' marks, and Rogers Test of Mathematical Ability as the predictive criteria, and the Breslich Algebra Test as the achievement criterion. He obtained the following correlations (1) Breslich Algebra Test and Otis Group I. Q. .54 (2) Breslich Algebra Test and Rogers Test .64 (3) Breslich Algebra Test and

4. Grover, C. C., "Results of An Experiment In Predicting Success In First Year Algebra In Two Oakland Junior High Schools," Journal of Educational Psychology, April, 1932, pp. 309-314.

5. Dicter, M. Richard, "Predicting Algebraic Ability," School Review, October, 1933, pp. 604-606.

Teachers' Mark .61.

He also found that a composite of intelligence quotient, the Rogers Test of Mathematical Ability and the teachers' marks is the most reliable of predictive criteria, obtaining a correlation of .74.

Lee and Hughes[6] set out to determine the value of a number of factors when used together to predict success in Algebra. Experimenting with 213 pupils and using the Kuhlman-Anderson Intelligence Test, the Terman Group Test of Mental Ability, the Lee Test of Algebraic Ability, teachers' marks, and chronological age as predictive criteria and the Columbia Research Algebra Test as the achievement criterion concluded that the best single prediction of achievement as measured by standardized tests was the aptitude test (Lee Test of Algebraic Ability) with a correlation of .62 and the best composite criteria were the Lee Test of Algebraic Ability and the Kuhlman-Anderson Intelligence Test with a correlation of .65.

According to Ayers[7], the best measure for predicting success in ninth grade algebra is a combination of a Prognostic Test, Reasoning Test, and the Teachers' estimate.

In an effort to determine the prognostic value of intelligence tests in predicting algebraic achievement, Mitchell[8] examined the records of 1146 pupils from 1921 to 1931 in West

6. Lee, J. M. & Hughes, W. H., "Predicting Success In Algebra and Geometry," School Review, March, 1934, pp. 188-196.

7. Ayers, G. H., "Predicting Success In Algebra," School And Society, January 6, 1934, pp. 17-18.

8. Mitchell, Claude, "Prognostic Value of Intelligence Tests," Journal of Educational Research, April, 1935, pp.577-582

Newton High School, Pennsylvania. He found that pupils with an I. Q. of 100 or more are almost certain to pass the subject of algebra-in fact 19 out of 20; that pupils with an I. Q. of less than 90 should not be encouraged to pursue algebra. He also found that the lower fifth of the group had a handicap of 21 times as many chances to drop out without finishing the course as those who rank in the highest fifth.

Douglas[9], after consideration of several studies of pupil success in high school mathematics, concludes that a pupil may pursue algebra if he has, (1) an intelligence quotient which is average or above, (2) previous marks in junior high school mathematics which are average or better, and (3) a score of average or better on a good prognostic test.

Clifton[10] in 1940 experimented with 214 students of the Tipton, Oklahoma schools using the sub-tests on the Stanford Achievement Test, chronological age, mental age, and teachers' marks as the predictive criteria found that a multiple correlation of .57 between sub-tests Arithmetic Reasoning, Reading, and the Otis intelligence quotient was the highest degree of efficiency in predicting algebraic success.

Layton[11], using the score on an algebra prognostic test,

9.  Douglas, Harl R., "Predicting of Pupil Success In High School Mathematics," Mathematics Teachers,December 1935, pp. 489-504.

10.  Clifton. L. L., "Prediction of High School Marks in Elementary Algebra," Journal of Experimental Education, June, 1940, pp. 410-413.

11.  Layton, R. B., "A Study of Prognosis In High School Algebra," Journal of Educational Research, April, 1941, pp.601-605.

an arithmetic test, the intelligence quotients, and teachers'
marks of 141 pupils in the junior high school of Jackson, Miss-
issippi, found that the teachers' marks were the highest coef-
ficient obtained with .82.

Guiler[12], whose work in this particular field of predict-
ing algebraic success has been prolific, using the scores on
(1) the Iowa Algebra Aptitude Test, (2) the Christofferson-
Rush-Guiler Analytical Survey Test In Computational Arithmetic
and (3) the Breslich Algebra Survey Test Form A, as predictive
factors and the Breslich Algebra Survey Test, Form B, as the
achievement factor, found that a multiple correlation of .83
(predictive factors number 2 and 3 respectively) was the high-
est degree of efficiency obtained.

In Cleveland, Ohio, according to Kraft[13], use is made of
the Iowa Algebra and Geometry Aptitude Tests as well as previous
scholarship record in all subjects in selecting pupils for the
study of algebra. Eighth graders are divided into three divi-
ions namely, (1) "the surely group" whose test score is 55 and
up and who are recommended to choose algebra, (2) "the positive-
ly no group" whose test score is 37 and below and not recommend-
ed, and (3) "the maybe group" whose test score ranges from 37 to
55 and whose choice of algebra depends upon other factors, such
as previous scholarship record. This latter criterion is the

12. Guiler, W. S., "Forecasting Achievement In Elementary
Algebra," Journal of Educational Research, September, 1944,
pp. 601-605.

13. Kraft, O., "Methods Used In The Selection of Pupils For
The Study of Algebra and Geometry In Cleveland, Ohio," Mathemat-
ics Teacher, May, 1946, pp. 236-239.

best single predictive measure, according to Kraft[14].

Grime[15], however in a study in the same city, Cleveland, and a year later than the study by Kraft, concluded that the scores on the Iowa Algebra Aptitude Test Correlated so nearly as well with the achievement criterion as combinations of predictive criteria did, that the Iowa Algebra Aptitude Test is in exclusive use in that school system for selecting pupils who wish to pursue ninth grade algebra.

Summing up this chapter we find that: (1) McCuen and Mitchell would favor the I. Q. scores in predicting Algebraic success, (2) that Lee and Grime consider the algebra aptitude test as worthwhile criteria for predicting algebraic success, (3) that Dunn and Layton place much emphasis in teachers' marks in arithmetic, (4) that Ayers, Dicter, Lee, Hughes, Clifton, Guiler and Douglas consider the composite of several criteria (although not necessarity the same criteria) as the best basis for predicting success in ninth grade algebra, (5) that Grover alone among the investigators favored a standard achievement test as the best criterion, and (6) Kraft would lean toward previous scholarship record in all subjects as perhaps the best single criterion for predicting algebraic success.

Conclusions from this chapter:

1.  The marked variance among authorities in the field as to the best measure or measures for predicting success in ninth grade algebra.

15.  Grime, H. E., "Aptitude And Ability In Elementary Algebra," School Science And Mathematics, December, 1947, pp. 781-784..

2. That reliance should not be placed on any one test or criterion, but a careful study made of the individual school situation and the results used that show the highest predictive value.

3. Therefore, it was the purpose of this study to attempt to discover a technique for predicting success in ninth grade algebra for pupils in the High Schools of Orange and Athol, Massachusetts, based on certain eighth grade criteria..

## Chapter Three

### THE DATA AND THEIR TREATMENT

Data---In the last two weeks of May, 1947 twenty-seven eighth
grade students of the Orange, Massachusetts public schools and
thirty-three eighth grade students of the Athol, Massachusetts
public schools, making a total of 60 in all, who had selected
ninth grade algebra for the succeeding freshman year were ad-
ministered the following tests:

A.   The Pintner General Ability Test, Verbal Series, Inter-
mediate Test, Form A

B.   The Orleans Algebra Prognostic Test, Form A

C.   The Stanford Achievement Advanced Arithmetic Test, Form
D

D.   The Kuder Preference Record, Form BB

The scores on these tests, along with the teachers' mark
in eighth grade arithmetic of the sixty students,  served as
the predictive criteria in this study.  To simplify statistical
procedure the teachers' marks were equated from a letter mark
to a numerical score as follows:

$$A = 5$$
$$B = 4$$
$$C = 3$$
$$D = 2$$
$$E = 1$$

Also in this study the scores from each of the arithmetic
computation and arithmetic reasoning sub-tests of the Stanford

Achievement Advanced Arithmetic Test were averaged and listed in one score.

In the Kuder Preference Record (And it is in this area where the study differs from others of its kind in the past) only the score on the sub-test, Computational, was used, because the scores on the other eight sub-tests of the Record were too inclusive to employ as a predictive criterion.

At the close of the first semester in January, 1948 the sixty students were administered the Columbia Research Bureau Algebra Test, Form A, Part I. The scores on this test served as the achievement criterion in this study.

In Table I are recorded the basic data of this study. To simplify handling the data were recorded in the following manner:

Name of student (Recorded as a number)

Column 1 Pintner I. Q. score (Recorded as I. Q.)

Column 2 Teachers' Mark (Grade Eight Arithmetic) (Recorded as T. M.)

Column 3 Orleans Prognostic Algebra Test Score (Recorded as O. P.)

Column 4 Stanford Arithmetic Achievement Test Score (Recorded as S. A.)

Column 5 Kuder Preference Record, (Computational score) (Recorded as K. P. R.)

Column 6 Columbia Research Bureau Algebra Test, (Part I Score) (Recorded as C. R. A.)

Sex of Student

## Table I

Raw Scores, Means,
Standard Deviations Of The
Sixty Pupils Used In This Study

| Pupil Number | I. Q. (1) | T. M. (2) | O. P. (3) | S. A. (4) | K. P. R. (5) | C. R. A. (6) | Sex |
|---|---|---|---|---|---|---|---|
| 1 | 144 | A-5 | 147 | 86 | 97 | 49 | F |
| 2 | 135 | A-5 | 126 | 81 | 84 | 30 | F |
| 3 | 128 | B-4 | 85 | 71 | 84 | 36 | M |
| 4 | 128 | A-5 | 185 | 90 | 75 | 50 | M |
| 5 | 123 | B-4 | 76 | 66 | 59 | 36 | M |
| 6 | 122 | A-5 | 124 | 81 | 55 | 41 | F |
| 7 | 122 | A-5 | 109 | 80 | 71 | 44 | F |
| 8 | 119 | B-4 | 100 | 78 | 88 | 34 | F |
| 9 | 118 | B-4 | 114 | 78 | 44 | 40 | M |
| 10 | 117 | B-4 | 112 | 71 | 92 | 29 | F |
| 11 | 117 | C-3 | 94 | 70 | 25 | 34 | M |
| 12 | 116 | B-4 | 68 | 65 | 4 | 32 | M |
| 13 | 116 | A-5 | 116 | 84 | 84 | 48 | F |
| 14 | 114 | A-5 | 130 | 89 | 92 | 43 | F |
| 15 | 113 | C-3 | 59 | 65 | 78 | 34 | M |
| 16 | 113 | A-5 | 132 | 83 | 71 | 31 | F |
| 17 | 113 | B-4 | 88 | 78 | 58 | 38 | F |
| 18 | 112 | C-3 | 91 | 66 | 8 | 32 | F |
| 19 | 112 | B-4 | 149 | 78 | 65 | 44 | F |
| 20 | 112 | B-4 | 124 | 69 | 92 | 27 | F |
| 21 | 110 | C-3 | 100 | 67 | 22 | 34 | M |
| 22 | 110 | C-3 | 67 | 73 | 5 | 31 | M |

Table I continued

| Pupil Number | I. Q. (1) | T. M. (2) | O. P. (3) | S. A. (4) | K.P.R. (5) | C.R.A. (6) | Sex |
|---|---|---|---|---|---|---|---|
| 23 | 109 | C-3 | 62 | 69 | 14 | 15 | F |
| 24 | 108 | C-3 | 67 | 63 | 40 | 32 | F |
| 25 | 108 | B-4 | 86 | 68 | 45 | 25 | F |
| 26 | 107 | D-2 | 65 | 60 | 25 | 21 | F |
| 27 | 107 | C-3 | 73 | 70 | 9 | 35 | M |
| 28 | 107 | C-3 | 61 | 66 | 40 | 18 | F |
| 29 | 106 | B-4 | 83 | 76 | 34 | 28 | F |
| 30 | 105 | C-3 | 83 | 74 | 37 | 34 | M |
| 31 | 104 | A-5 | 118 | 79 | 93 | 37 | F |
| 32 | 104 | C-3 | 128 | 67 | 73 | 33 | F |
| 33 | 103 | B-4 | 69 | 73 | 60 | 23 | M |
| 34 | 103 | C-3 | 72 | 62 | 44 | 22 | M |
| 35 | 102 | C-3 | 55 | 67 | 50 | 31 | F |
| 36 | 102 | B-4 | 92 | 81 | 18 | 30 | M |
| 37 | 101 | D-2 | 66 | 72 | 65 | 21 | M |
| 38 | 101 | D-2 | 56 | 67 | 77 | 19 | M |
| 39 | 101 | C-3 | 130 | 70 | 88 | 23 | F |
| 40 | 101 | D-2 | 84 | 65 | 54 | 32 | M |
| 41 | 100 | C-3 | 92 | 60 | 30 | 36 | M |
| 42 | 100 | A-5 | 88 | 81 | 92 | 31 | F |
| 43 | 100 | A-5 | 105 | 85 | 96 | 41 | F |
| 44 | 99 | F-1 | 67 | 66 | 9 | 17 | M |
| 45 | 99 | C-3 | 43 | 67 | 53 | 19 | M |
| 46 | 99 | B-4 | 91 | 77 | 53 | 31 | M |

Table I continued

| Pupil Number | I. Q. (1) | T. M. (2) | O. P. (3) | S. A. (4) | K. P. (5) | R. C. R. A. (6) | Sex |
|---|---|---|---|---|---|---|---|
| 47 | 98 | B-4 | 73 | 70 | 45 | 21 | F |
| 48 | 98 | A-5 | 83 | 76 | 32 | 34 | M |
| 49 | 97 | B-4 | 63 | 65 | 45 | 21 | F |
| 50 | 97 | C-3 | 53 | 72 | 57 | 33 | F |
| 51 | 97 | B-4 | 73 | 70 | 71 | 32 | F |
| 52 | 97 | B-4 | 85 | 75 | 84 | 27 | F |
| 53 | 96 | B-4 | 100 | 68 | 54 | 29 | M |
| 54 | 96 | B-4 | 96 | 76 | 34 | 42 | M |
| 55 | 96 | D-2 | 40 | 60 | 8 | 17 | M |
| 56 | 96 | B-4 | 43 | 67 | 32 | 21 | F |
| 57 | 95 | F-1 | 41 | 55 | 8 | 15 | M |
| 58 | 96 | B-4 | 85 | 70 | 29 | 17 | F |
| 59 | 94 | C-3 | 43 | 72 | 52 | 12 | M |
| 60 | 84 | D-2 | 47 | 67 | 68 | 16 | M |
| Mean | 107 | 3.6 | 87.8 | 72.4 | 52.8 | 29.9 | |
| Standard Deviation | 11 | 2 | 27 | 7 | 27 | 9 | |

A break-down of the table reveals the following information.

Of the sixty students participating in the study, thirty-two were girls and twenty-eight were boys. In Column 1, I. Q. scores, the range was 84 to 144, with a mean of 107.

In Column 2, Teachers' eighth grade arithmetic mark, twelve pupils had A's, twenty-two pupils had B's, eighteen had C's, six had D's, and two had F's; the mean was 3.6 on the equated numerical score or between C and B. In column 3, Orleans Algebra Prognostic scores, the range was 40 to 147, with a mean of 87.8 which is comparable to the median quartile. In column 4, Stanford Arithmetic Achievement test, the range was 55 to 90, with a mean of 72 which is comparable to a grade equivalent of 9.5. In column 5, Kuder Preference Record Score, the range was 5 to 97, with a mean of 58, comparable to the $38^{th}$ percentile for boys, and the $30^{th}$ percentile for girls. In column 6, Columbia Research Algebra Score, the range was 12 to 50, with a mean of 30, comparable to the median quartile.

## Treatment of Data

The following statistical procedure was used in the analysis of the data.

The zero order coefficient of correlation, was determined by the Otis Correlation Chart[16] which makes use of the following formula:

$$r = \frac{\Sigma x^2 + \Sigma y^2 - \Sigma v^2}{2\sqrt{\Sigma x^2 \ \Sigma y^2}}$$

wherein r represents the coefficient of correlation.

The multiple coefficient of correlation, first order, was determined by the following formula[17]:

$$Rc_{12} = \sqrt{\frac{r^2c_1 + r^2c_2 - 2rc_1 \ rc_2 \ r_{12}}{1 - r^2_{12}}}$$

wherein Rc.12 represents the highest correlation that is possible between a combined score in Tests 1 and 2, 1 and 3, 1 and 4 etc. and the achievement criterion.
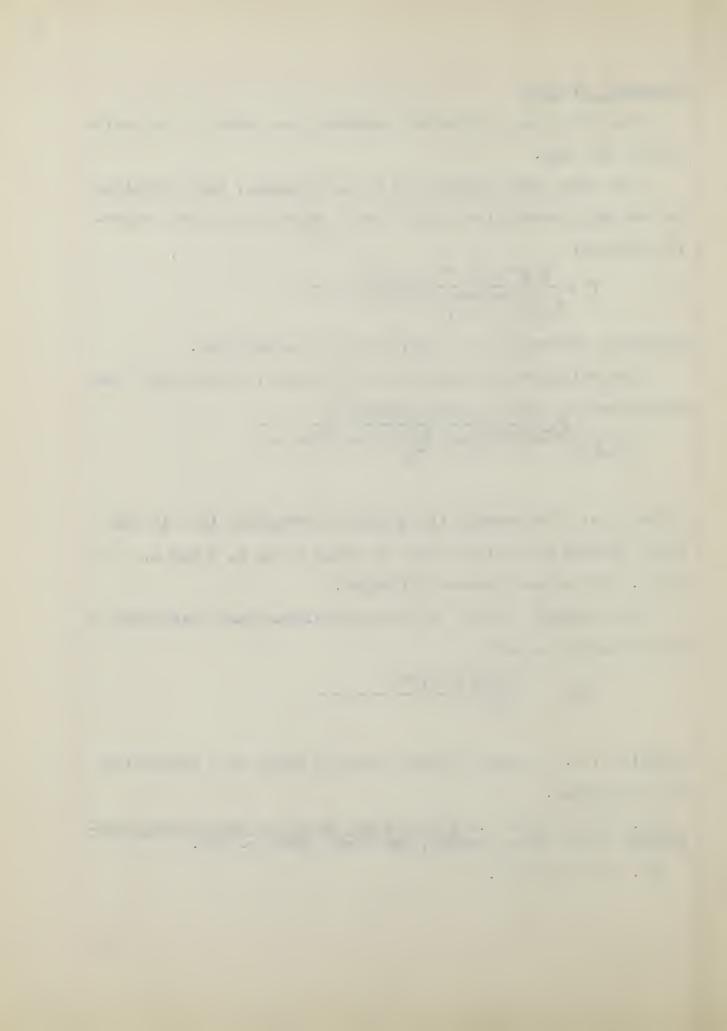
The probable errors of the coefficients were determined by the following formula:

$$P.E.r = \frac{.6745 (1 - r^2)}{\sqrt{N}}$$

wherein P. E. r stands for the probable error of a coefficient of correlation.

16. Otis, Arthur S., _Statistical Method In Educational Measurement_, World Book Company, New York, 1925, p. 192.

17.  Ibid, P. 239.

The above formulas and their application to the basic data as presented in Table I will be amplified in the following chapter.

# Chapter Four

## STATISTICAL AND DESCRIPTIVE PROCEDURE

The purpose of this study was to attempt to discover a technique for predicting success in ninth grade algebra for students of the Athol and Orange, Massachusetts High Schools on the basis of certain eighth grade criteria.
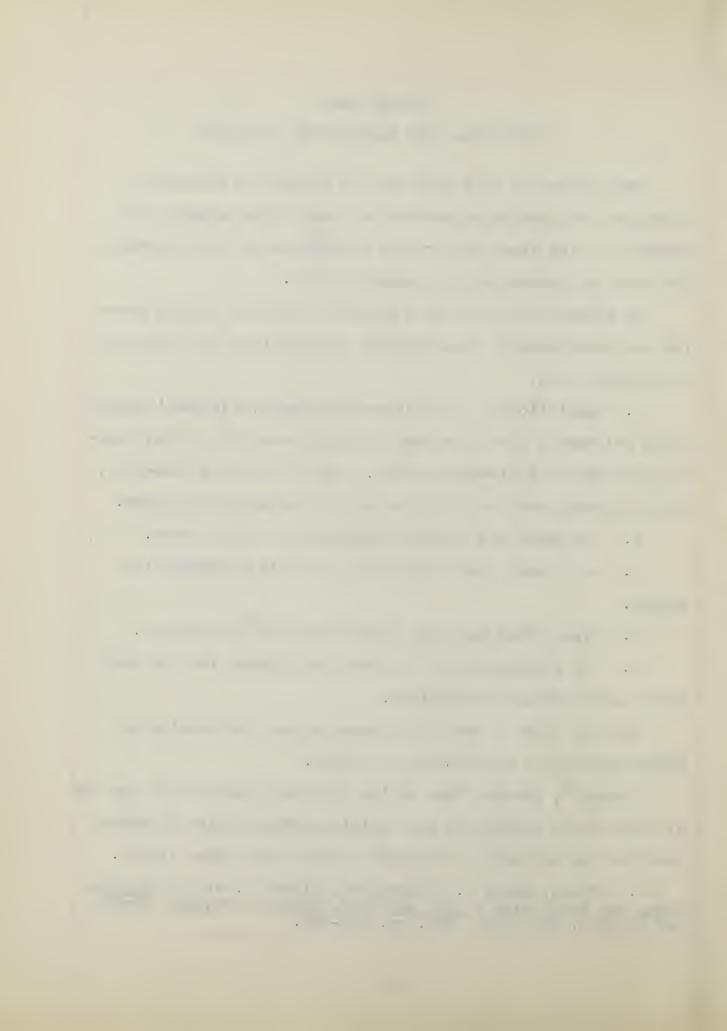
An attempt to arrive at a possible solution of this problem was undertaken by examining and interpreting the following statistical data:

1. Tabulation of intelligence quotients, teachers' eighth grade arithmetic marks, Orleans Algebra Prognostic score, Stanford Arithmetic Achievement score, Kuder Preference (Sub-test, Computational) and the Columbia Research Algebra Test score.

2. The means and standard deviations of the scores.

3. Zero order coefficients of correlation between the scores.

4. First Order multiple coefficients of correlation.

5. The probable errors of the coefficients for the zero order and multiple correlations.

At this point a word of explanation and the meaning and interpretation of correlation is needed.

Greene[18] states, "One of the important outcomes of the use of correlation methods is that within certain limits it makes possible the estimating of unknown values from known values.

18. Greene, Harry A. & Jorgensen, Albert N. et al, Measurements and Evaluation In The Secondary School, Longmans, Green and Company, New York, 1944, pp. 563-564.

The accuracy of this estimate, however, depends directly upon the correlation between the factors measured. As the amount of the correlation decreases, the accuracy of the forecast declines, but not in a direct manner. A correlation 1.0 means 100 per cent accuracy, but a correlation of .50 does not mean at all that the estimate based on it will be 50 percent correct." The following table[19] will demonstrate this fact.

Table II

Percentage Of
Forecasting Accuracy
For Specific Values of Correlation

| Coefficient Of Correlation | Percent of Forecasting Efficiency |
|---|---|
| 1.00.................................1.00 |
| .99.................................... 86 |
| .98.................................... 80 |
| .95.................................... 69 |
| .90.................................... 56 |
| .866................................... 50 |
| .80.................................... 40 |
| .75.................................... 34 |
| .70.................................... 29 |
| .65.................................... 24 |
| .60.................................... 20 |
| .50.................................... 13 |
| .40.................................... 8 |
| .30.................................... 5 |
| .20.................................... 2 |
| .10.................................... $\frac{1}{2}$ |

The foregoing table will serve a useful purpose and act as a safeguard in interpreting the coefficients of correlation obtained in this study.

Table III shows the zero order and first order multiple coefficients of correlation and their probable errors. As previously stated in Chapter Three the scores on the variables used

19. Ibid, p. 563.

## **Table** III

### Zero Order And First
### Order Multiple Coefficients Of
### Correlation Of The Criteria Used In This Study

| Zero Order | | First Order Multiple | |
|---|---|---|---|
| Criteria | Coefficients | Criteria | Coefficients |
| r12 | .44±.07 | r6.12 | .69±.05 |
| r13 | .64±.05 | r6.13 | .80±.03 |
| r14 | .45±.07 | r6.14 | .77±.03 |
| r15 | .26±.08 | r6.15 | .65±.05 |
| r16 | .63±.04 | r6.23 | .68±.05 |
| r23 | .69±.04 | r6.24 | .58±.05 |
| r24 | .73±.04 | r6.25 | .54±.06 |
| r25 | .57±.06 | r6.34 | .80±.03 |
| r26 | .54±.06 | r6.35 | .80±.03 |
| r34 | .74±.04 | r6.45 | .67±.05 |
| r35 | .53±.05 | | |
| r36 | .80±.03 | | |
| r45 | .50±.06 | | |
| r46 | .67±.05 | | |
| r56 | .32±.07 | | |

in this study have been assigned the following numbers and henceforth will be referred to be these numbers.  In this manner ease of interpretation will be facilitated.

1.  Intelligence Quotients.

2.  Teachers' Arithmetic Marks, grade eight

3.  Orleans Algebra Prognostic Score

4.  Stanford Arithmetic Achievement Score

5.  Kuder Preference Record Score, (Sub-test Computational)

6.  Columbia Research Algebra Score.

An inspection of Table III, shows the following results.

All zero order coefficients are positive.

The highest correlation, .80$\pm$.03, was between the predictive criterion (3) Orleans Algebra Prognostic Test and (6) Columbia Research Algebra Test, the achievement criterion.  This would seem logical because the Orleans Test was built for the purpose of forecasting algebraic success, not always, however, with a correlation of .80 as found in this study.

The predictive criterion (4) Stanford Arithmetic Achievement Test and (6) the achievement criterion, Columbia Research Algebra Test yielded the second highest correlation .67$\pm$.05 which could be expected, both being mathematical scores.

The lowest zero order coefficient .32$\pm$.07 between (5) Kuder Preference Record, (Sub-test, Computational) and (6) Columbia Research Algebra Test would seem to indicate that preference is not a factor in forecasting algebraic success.

Although (2) Teachers' Mark and (4) Stanford Arithmetic Achievement correlated favorably with .73$\pm$.04, this was not

true when the same (2) Teachers' Marks were correlated with
(6) Columbia Research Algebra Test, the correlation being
.54$\pm$.06 almost a drop of 20 points.

The (3) Orleans Algebra Prognostic score maintained a
favorably higher correlation in relationship to all predic-
tive criteria in the study than any other respective criterion
with $r_{13}$= .64$\pm$.05,  $r_{23}$= .69$\pm$.05, $r_{34}$=.74$\pm$.04,  $r_{35}$= .53$\pm$.05,
and $r_{36}$=.80$\pm$.03.

By studying the results of the multiple correlations in
Table III further improvement in the efficiency of the accuracy
of predicting success in ninth grade algebra is shown in some
instances.

In the multiple correlations the dominant predictive cri-
terion was (3) Orleans Algebra Prognostic Test when combined
with the other predictive criteria as shown by increases of .16
when combined with I. Q., .14 when combined with Teachers'
Marks, .13 when combined with Stanford Arithmetic Achievement
Test, and .48 when combined with Kuder Preference Record.

The influence of the I. Q. was next in order of increase
when added to the other predictive criteria as shown by the fol-
lowing increases, .11 when combined with Teachers' Marks, .00
when combined with Orleans Algebra Prognostic Test, .10 when
combined with Stanford Arithmetic Achievement Test, and .33
when combined with Kuder Preference Record.

The Kuder Preference Record wielded the least amount of in-
fluence when combined with the other predictive criteria as
shown by the following figures;  .01 when combined with I. Q.,

.OO when combined with Teachers' Marks, Orleans Prognostic Test, and Stanford Arithmetic Achievement Test respectively.

The negative influence of Teachers' Marks when combined with the other predictive criteria is shown by a minus .12 when combined with Stanford Achievement Test.

The gains made by the Stanford Arithmetic Achievement Test when combined with the other predictive criteria is shown by the following figures .13 when combined with I. Q., .04 when combined with Teachers' Marks, .OO when combined with Orleans Algebra Prognostic Test, and .35 when combined with Kuder Preference Record.

The highest multiple correlations of .80±.03 in the instances of R6.13, Columbia Research Algebra Test combined with I. Q. and Orleans Algebra Prognostic Test; R6.34, Columbia Research Algebra Test combined with Orleans Algebra Prognostic Test and Stanford Arithmetic Achievement Test; and R6.35 Columbia Research Algebra Test combined with Orleans Algebra Prognostic Test and Kuder Preference Record, did not exceed the highest zero order correlation of .80±.03 in the instance of r36 Orleans Algebra Prognostic Test and Columbia Research Algebra Test.

## Chapter Five

### SUMMARY AND CONCLUSIONS

Five predictive criteria, (1) Pintner I.Q.'s, (2) Teachers'
eighth grade arithmetic marks, (3) Orleans Algebra Prognostic
Test scores, (4) Stanford Arithmetic Achievement Test scores,
and (5) Kuder Preference Record (Sub-test, Computational)
scores were correlated with (6) the Columbia Research Algebra
Test scores (Achievement criterion) to determine the best cri-
terion for predicting success in ninth grade algebra.

Sixty pupils of the ninth grade Algebra classes in the
High Schools of Orange, and Athol, Massachusetts were the samp-
lings used in the study.

The means, and standard deviations were found.

The zero order and first order multiple coefficient corre-
lations were found, along with their probable errors.
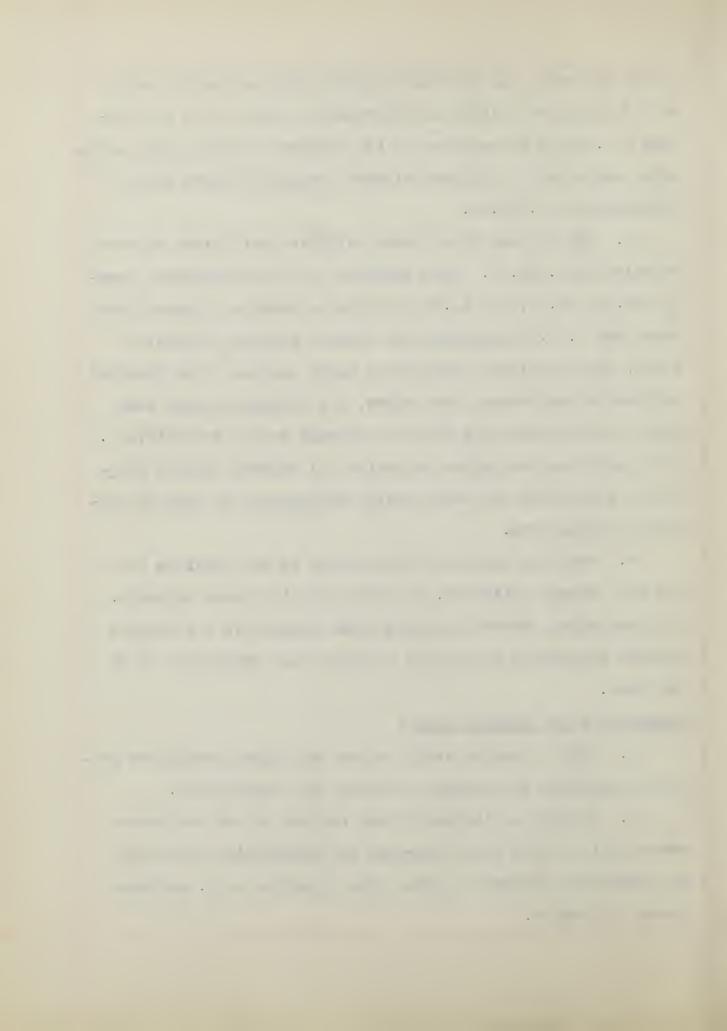
The results of the study are summarized as follows:

1.  The highest zero order of coefficient of correlation
obtained among the predictive criteria, (1) I. Q.'s, (2) Tea-
chers' eighth grade arithmetic mark, (3) Orleans Algebra Prog-
nostic Test score, (4) Stanford Arithmetic Achievement Test
score, and (5) Kuder Preference Record score (Sub-test compu-
tational) when correlated with the achievement criterion
(6) Columbia Research Algebra Test was (3) Orleans Algebra
Prognostic Test with a correlation of .80$\pm$.03.

2.  This same predictive criterion (3) also made the best
showing throughout the data on zero order correlations, except

in one instance, (2) Teachers' eighth grade arithmetic marks and (4) S$_+$anford Arithmetic Achievement score with a correlation of .73$\pm$.04 as compared to (2) Teachers' eighth grade arithmetic marks and (3) Orleans Algebra Prognostic score with a correlation of .69$\pm$.04.

3.  The highest first order multiple coefficient of correlation was .80$\pm$.03. This occurred in three instances; namely, R6.13, R6.34, and R6.35 or Columbia Research Algebra Test score and I. Q.'s combined with Orleans Algebra Prognostic score, Orleans Algebra Prognostic Score combined with Stanford Arithmetic Achievement Test score, and Orleans Algebra Test score combined with the Kuder Preference Record respectively. Here again the predictive criterion (3) Orleans Algebra Prognostic Score made the best showing throughout the data on multiple correlations.

4.  From the results of this study we may conclude that the best single criterion, or when used with other criteria, for predicting success in ninth grade algebra is the Orleans Algebra Prognostic Test, with a forecasting efficiency of 40 per cent.

Suggestions for further study:

1.  That a similar study be made but using predictive criteria involving the factors, interest and study-skill.

2.  Attempt to discover other factors as yet not experimented with, which might increase the forecasting efficienty of predicting success in ninth grade algebra, e. g. environmental influence.

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